

Association and Viscosity of Acetic Acid Vapor

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Results of new relative high-precision measurements on the vapor of acetic acid are reported. The reproducibility of the measurements is found to be 0.1%, whereas the uncertainty is estimated to be 0.2% near room temperature, increasing up to 0.3% at high temperature. Twenty series, each differing in density, were performed in a quartz oscillating-disk viscometer from 298 to 598 K and for densities between 1-61 mol·m⁻³. Some experimental points correspond to measurements in the saturated vapor. Isothermal values, recalculated from the original isochoric data, were first evaluated with an expansion, in terms of density of the monomers, for the viscosity. The isotherms, particularly at low temperatures, show a strong curvature with a much higher negative slope compared with other substances. Earlier measurements by Timrot et al. [1] show good agreement with the present results. The further evaluation accounts for the fact that a strong dimerization depending on temperature occurs in acetic acid vapor. The volumetric behavior of acetic acid is taken into consideration in the first step as an ideal association. The resulting isotherms, in terms of the mole fraction of the monomers, show a much smaller curvature. In a second step the intermolecular forces between the monomers and dimers are additionally considered based on the evaluation of the volumetric behavior of acetic acid vapor with an equation of state for a reactive fluid by Bich et al. [2].

[1] D.L. Timrot, M.A. Serednitskaya, and M.S. Bepalov, *Teplofiz. Vys. Temp.* 14, 1192 (1976).

[2] E. Bich, A.-K. Neumann, and E. Vogel, *Fluid Phase Equilib.* 125, 67 (1996).